Analysis of surface compositions in the Oxia Palus region on Mars from Mars Global Surveyor Thermal Emission Spectrometer Observations

Michael B. Wyatt
Department of Geological Sciences, Arizona State University, Tempe, Arizona, USA

Harry Y. McSween Jr. and Jeffrey E. Moersch
Department of Geological Sciences, University of Tennessee, Knoxville, Tennessee, USA

Phillip R. Christensen
Department of Geological Sciences, Arizona State University, Tempe, Arizona, USA

Received 30 September 2002; revised 19 March 2003; accepted 6 May 2003; published 13 September 2003.

[1] We examine the distribution of Thermal Emission Spectrometer (TES) derived surface compositions in the Oxia Palus region on Mars through high-spatial-resolution mapping and integration with Mars Orbiter Camera and Mars Orbiter Laser Altimeter data sets. We also fit the basalt and andesite-weathered basalt interpretations of TES surface type 1 and type 2 materials into multiple working hypotheses to describe the origin of surface compositions. A mixing/transition from surface type 1 to type 2 is observed in low-albedo regions of southern Acidalia Planitia and may represent either (1) an influx of basaltic sediment from the southern highlands, deposited on and mixed with andesitic volcanics; (2) an influx of water-transported basaltic sediment from the southern highlands that was altered and later deposited as a thin sedimentary veneer; or (3) different degrees of weathering of indigenous basalt, marking the geographic extent of submarine alteration of basaltic crust. TES spectra of low-albedo intracrater materials reveal that surface type 1 compositions form a central core on crater floors, while type 2 compositions form a surrounding arc on the dark downwind sides of crater walls. Intracrater floor materials are interpreted as eolian sediment, and wall materials are interpreted as either eolian sediment or eroded material from in-place crater wall lithologies. Surface type 1 and type 2 compositions are also observed in adjacent low-albedo wind streaks; however, a mixing trend is not as evident. The Mars Pathfinder landing site and Ares and Tiu Valles source regions are sufficiently blanketed by fine-grained dust to prohibit the analysis of surface rock compositions. *INDEX TERMS:* 6225 Planetology: Solar System Objects: Mars; 5470 Planetology: Solid Surface Planets: Surface materials and properties; 5410 Planetology: Solid Surface Planets: Composition; 5480 Planetology: Solid Surface Planets: Volcanism (8450); *KEYWORDS:* Mars, Mars Global Surveyor, thermal emission spectrometer, MGS, TES

Citation: Wyatt, M. B., H. Y. McSween Jr., J. E. Moersch, and P. R. Christensen, Analysis of surface compositions in the Oxia Palus region on Mars from Mars Global Surveyor Thermal Emission Spectrometer Observations, *J. Geophys. Res.*, *108*(E9), 5107, doi:10.1029/2002JE001986, 2003.

1. Introduction

[2] Atmospherically corrected thermal emissivity data [*Bandfield et al.*, 2000a; *Smith et al.*, 2000] from the Mars Global Surveyor (MGS) Thermal Emission Spectrometer (TES) have been used to identify two unique global-scale surface lithologies [*Bandfield et al.*, 2000b; *Christensen et al.*, 2000a]. Surface type 1 and type 2 spectral units are divided roughly along the planetary dichotomy that separates ancient, heavily cratered crust in the southern hemisphere from younger lowland plains in the north [*Bandfield et al.*, 2000b; *Rogers et al.*, 2001]. The surface type 1 spectral end-member is characterized by high abundances of plagioclase and pyroxene and is interpreted as largely unweathered basalt [*Christensen et al.*, 2000a; *Bandfield et al.*, 2000b; *Hamilton et al.*, 2001]. The surface type 2 spectral end-member has been interpreted either as andesite with high modal plagioclase and volcanic glass and low modal pyroxene [*Bandfield et al.*, 2000b; *Hamilton et al.*, 2001] or as partly weathered basalt with high modal plagioclase and alteration phases (clays and silica coatings) and low modal pyroxene [*Wyatt and McSween*, 2002].

[3] The Oxia Palus quadrangle on Mars is unique in that it encompasses the geographic and compositional transition between the southern highlands and northern lowlands and

0148-0227/03/2002JE001986$09.00